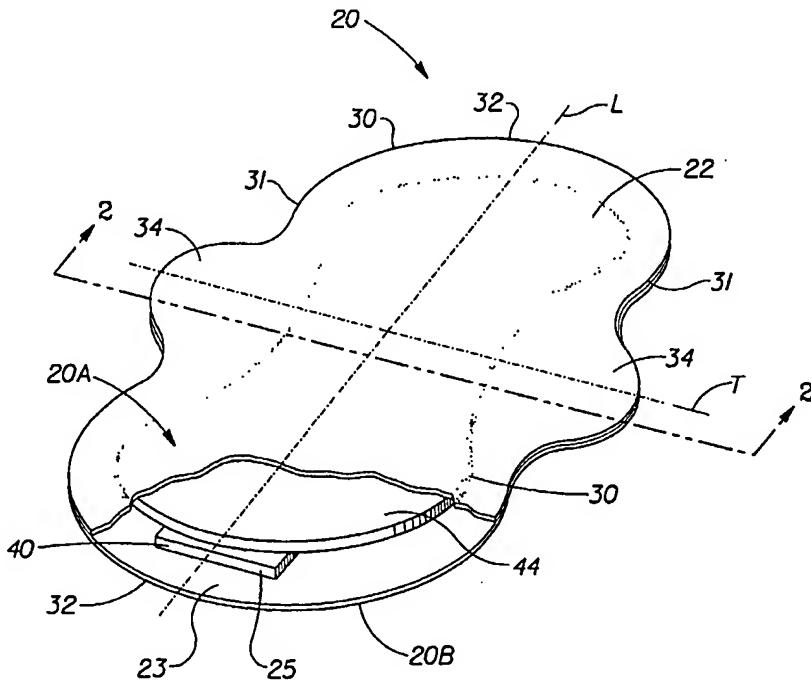




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<p>(54) Title: ABSORBENT CORE LAYER FOR ABSORBENT ARTICLES</p> <p>(57) Abstract</p> <p>Absorbent webs having improved fluid acquisition and retention properties are disclosed. The present invention further relates to absorbent articles such as sanitary napkins, diapers, adult incontinence pads and briefs, panty liners, tampons, and the like, incorporating such webs (such as for an absorbent core). The fibrous absorbent web of the present invention is an airlaid fibrous web which includes a substantially uniform admixture of hardwood pulp fibers (such as eucalyptus fibers) and softwood pulp fibers (such as southern softwood kraft fibers). Preferably, the fibrous absorbent web also incorporates superabsorbent material throughout the web. The fibrous web layer may also incorporate a binder material such as bicomponent binder fibers in the uniform admixture of fibers described. One or more webs of the present invention may make up the absorbent core of a disposable absorbent article. The web layer of the present invention provides high capillary pressure and improved fluid distribution. Additionally, because of its airlaid nature, it is possible to incorporate superabsorbent material throughout the web and to achieve improved stiffness control over the resulting web as compared to previous webs.</p>			



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ABSORBENT CORE LAYER FOR ABSORBENT ARTICLES

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FIELD OF THE INVENTION

The present invention relates to absorbent webs having improved fluid acquisition and retention properties. The present invention further relates to absorbent articles such as sanitary napkins, diapers, adult incontinence pads and briefs, panty liners, tampons, and the like, incorporating such webs (such as for an absorbent core).

BACKGROUND OF THE INVENTION

Absorbent webs which comprise entangled masses of fibers, i.e. fibrous absorbent webs, are well known in the art. Such absorbent webs are used in all manner and variety of disposable absorbent articles such as diapers, sanitary napkins, panty liners, incontinence pads and briefs, tampons, and the like. Typical disposable absorbent articles often comprise a liquid pervious body side liner and an underlying absorbent core. The absorbent core may be sandwiched between a body side liner and a liquid impervious backsheets, which backsheets serve to protect garments and skin from contact with absorbed bodily discharges. Typically body side liners may comprise a topsheet such as an apertured formed film or a nonwoven topsheet layer. A body side liner may also comprise a multiple layer structure such as a topsheet in liquid communication with a secondary topsheet (which is also sometimes referred to as a distribution layer, surge management layer, wicking layer, or similar term).

The core of the typical absorbent article described above has two basic requirements: to drain the body side liner of deposited fluids and draw these fluids into the absorbent core for absorption, and to resist subsequent release of previously absorbed fluid as a result of pressure exerted on the core or article as a whole (i.e. avoid "squeeze out" of the core). Other considerations, such as the overall capacity of the absorbent

core, its thickness, and its stiffness are also important with respect to the design of superior absorbent articles.

The body side liner of absorbent articles such as those described above, preferably 5 allows deposited fluids to penetrate quickly the surface of the liner (i.e. liner should exhibit high strike-through). Additionally, once fluids penetrate the liner, they should not flow back to the surface of the liner (i.e. liner should exhibit low re-wet). Preferred body side liners are also as soft, comfortable, and as non-irritating to the skin of the user as possible.

10 To some extent, the desired characteristics of the body side liner and the absorbent core are related. For example, a core which exhibits a high capillary pressure will also have an increased tendency to drain fluids from the body side liner, thus assisting the body side liner in demonstrating low re-wet. Consequently, the design of an overall absorbent article may involve several tradeoffs in design considerations. It has been 15 found during development of the present invention that it is possible to achieve advances in the softness of the topsheet by designing an absorbent core which improves the performance of the body side liner with respect to rewet as compared to other cores. In other words, by utilizing a core of the present invention, the body side liner, and the topsheet in particular may be made with a reduced caliper under pressure without a 20 corresponding increase in rewet performance of the overall absorbent article. The absorbent core of the present invention also allows for improved positive control of stiffness as compared to other types of absorbent webs. Such stiffness control provides great flexibility in controlling the stiffness of an overall disposable absorbent article.

25 The absorbent web of the present invention utilizes a combination of hardwood pulp fibers and softwood pulp fibers in an airlaid fibrous web. The incorporation of the hardwood fibers in the combinations described allows for increased capillary pressure and improved fluid distribution compared to absorbent webs without such fiber content. Additionally, by making such a web an airlaid structure, it is possible to incorporate superabsorbent material throughout the web and to achieve improved stiffness control 30 over the resulting web as compared to previous absorbent webs. Consequently, the absorbent web of the present invention is particularly well suited for use as an absorbent core of a disposable absorbent article due to its high capacity through the use of fluid storage by osmotic means (such as superabsorbent material), and its high control over stiffness and other physical properties.

A wide variety of fibrous web structures are known in the art, and many of these have attempted to provide high suction and other desirable properties. For example, U.S. Patent 5,549,589 issued to Horney et al. describes a fluid distribution member comprising chemically stiffened, twisted, and curled bulking fibers; high surface area fibers eucalyptus fibers, and thermoplastic binder fibers. Nevertheless, the Horney device does not provide the unique combination of hardwood and softwood pulp fibers in an airlaid structure described herein. Additionally, the Horney device does not readily allow for the incorporation of superabsorbent particle material throughout the web as is the case with the absorbent web of the present invention.

Another absorbent structure is described in U.S. Patents 5,009,650 and 4,699,619 both issued to Bernardin. The Bernardin devices incorporate a layer of primarily softwood pulp fiber overlaying a layer of primarily hardwood pulp fiber. The Bernardin device, however, does not achieve the benefits of uniform admixture of the fibers demonstrated by the present invention. Additionally, the Bernardin device fails to incorporate superabsorbent particles throughout the layer. The use of bicomponent fibers for bonding of the web layer is also not described.

SUMMARY OF THE INVENTION

The present invention relates to absorbent webs having improved fluid acquisition and retention properties. The present invention further relates to absorbent articles incorporating such webs as absorbent cores which can be used in absorbent articles such as sanitary napkins, diapers, adult incontinence pads and briefs, panty liners, tampons, and the like.

In one embodiment of the present invention, the absorbent web of the present invention comprises a multiplicity of hardwood pulp fibers, a multiplicity of softwood pulp fibers, and a superabsorbent material. The hardwood and softwood fibers and the superabsorbent are present in a substantially uniform admixture throughout the web which is an airlaid web structure. The hardwood pulp fibers may preferably comprise eucalyptus fibers, the softwood pulp fibers may preferably comprise southern softwood kraft fibers. Preferably, the softwood and hardwood fibers are present in the web in a ratio of from about 4:1 to about 1:2, more preferably from about 3:1 to about 1:1.

In an additional embodiment, the absorbent web of the present invention comprises a multiplicity of hardwood pulp fibers, a multiplicity of softwood pulp fibers and a binder material. The hardwood pulp, softwood pulp and binder material are incorporated in a

substantially uniform admixture within an airlaid thermally bonded fibrous web. Preferably, the hardwood pulp fibers may comprise eucalyptus fibers, while the softwood pulp fibers may preferably comprise southern softwood kraft fibers. Preferably, the softwood fibers and the hardwood fibers are present in a ratio of from about 3:1 to about 1:1. Preferably, the web also incorporates a superabsorbent material throughout.

The absorbent web of the present invention is preferably incorporated into a disposable absorbent article comprising a liquid pervious topsheet, a liquid impervious backsheet joined to the topsheet, and an absorbent core disposed between the topsheet and the backsheet. The absorbent web of the present invention serves as the absorbent core of such disposable absorbent article. The liquid pervious topsheet of such absorbent article may preferably comprise a nonwoven web or an apertured formed film.

In an additional embodiment of the present invention the absorbent web of the present invention may comprise a multiplicity of hardwood pulp fibers and multiplicity of softwood pulp fibers. The hardwood and softwood pulp fibers are incorporated in a substantially uniform admixture within an airlaid fibrous web, which web has a Taber stiffness of less than about 3 Taber stiffness units. Preferably, the fibrous absorbent web further comprises a superabsorbent material incorporated throughout the web. The fibrous absorbent web of may also preferably comprise a multiplicity of bicomponent fibers incorporated in a substantially uniform admixture within the web. In one preferred embodiment, the softwood pulp fibers comprise southern softwood kraft fibers. The hardwood pulp fibers, in one preferred embodiment may comprise eucalyptus fibers.

The absorbent web of the present invention may also comprise a latex surface coating (e.g. as a process aid to control dusting). The absorbent web of the present invention may also be incorporated into a disposable absorbent article in which two web layers of the present invention serve as the absorbent core. Superabsorbent material may be disposed between such two web layers in such an embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view, partially sectioned, of a preferred embodiment of an absorbent article in the form of a sanitary napkin which includes an absorbent core according to the present invention.

FIG. 2 is a cross sectional view taken along line 2-2 of FIG. 1 showing the interior layers of sanitary napkin of FIG. 1 which includes an absorbent core according to the present invention.

5 FIG. 3 is a cross sectional view of a sanitary napkin in which the absorbent core which incorporates two absorbent webs of the present invention with a superabsorbent material disposed therebetween.

DETAILED DESCRIPTION OF THE INVENTION

10 The present invention relates to absorbent webs having improved fluid acquisition and retention properties. The present invention further relates to absorbent articles incorporating such webs as absorbent cores which can be used in absorbent articles such as sanitary napkins, diapers, adult incontinence pads and briefs, panty liners, tampons, and the like.

15 The absorbent web of the present invention can be utilized in disposable products which are capable of absorbing significant quantities of body fluids, such as urine, perspiration, menses, and water in body wastes. Such articles may be prepared in the form of disposable diapers, catamenial pads, adult incontinence briefs, tampons, and disposable towels and wipes, and the like. The web of the present invention is particularly suited for use as an absorbent core of such disposable absorbent products.

20 The absorbent articles herein generally comprise three basic structural components. One such component is a substantially liquid impervious backsheet. On top of this backsheet is disposed an absorbent core such as any of the fibrous absorbent webs of the present invention described herein. On top of this absorbent core and joined to the backsheet is a fluid pervious topsheet. Optionally, at least one acquisition component 25 (also sometimes referred to as a fluid distribution layer), may be located between the topsheet and the absorbent core.

30 A preferred embodiment of a unitary disposable absorbent article of the present invention is the catamenial pad, sanitary napkin 20, shown in FIGS. 1-2. As used herein, the term "sanitary napkin" refers to an absorbent article which is worn by females adjacent to the pudendal region, generally external to the urogenital region, and which is intended to absorb and contain menstrual fluids and other vaginal discharges from the wearer's body (e.g., blood, menses, and urine). Sanitary napkins which reside partially within and partially external of the wearer's vestibule are also within the scope of this

invention. As used herein, the term "pudendal" refers to the externally visible female genitalia. It should be understood, however, that the present invention is also applicable to other feminine hygiene or catamenial pads such as pantiliners, interlabial devices, or other absorbent articles such as incontinence pads, tampons, and the like.

FIG. 1 is a plan view of the sanitary napkin 20 of the present invention in its flat-out state with portions of the structure being cut-away to more clearly show the construction of the sanitary napkin 20. The portion of the sanitary napkin 20 which faces or contacts the wearer is oriented towards the viewer. FIG. 2 is a cross-sectional view of FIG. 1 taken along line 2-2 and which more clearly shows the interior structure of sanitary napkin 20.

As shown in FIGS. 1-2, the sanitary napkin 20 preferably comprises a liquid pervious topsheet 22, a liquid impervious backsheet 23 joined with the topsheet 22, and an absorbent core 25 of the present invention positioned between the topsheet 22 and the backsheet 23. The sanitary napkin 20 depicted in FIGS. 1-2 is a simplified absorbent article that could represent a sanitary napkin prior to its being placed on a wearer's undergarment. It should be understood, however, that the present invention is not limited to the particular type or configuration of sanitary napkin shown in FIGS. 1-2.

The sanitary napkin 20 has two surfaces, a body-contacting surface 20A or "body surface" and a garment surface 20B. The sanitary napkin 20 is shown in FIG. 1 as viewed from its body surface. The body surface 20A is intended to be worn adjacent to the body of the wearer while the garment surface 20B is on the opposite side and is intended to be placed adjacent to the wearer's undergarments when the sanitary napkin 20 is worn.

The sanitary napkin 20 has two centerlines, a longitudinal centerline "L" and a transverse centerline "T". The term "longitudinal", as used herein, refers to a line, axis or direction in the plane of the sanitary napkin 20 that is generally aligned with (e.g., approximately parallel to) a vertical plane which bisects a standing wearer into left and right body halves when the sanitary napkin 20 is worn. The terms "transverse" or "lateral" as used herein, are interchangeable, and refer to a line, axis or direction which lies within the plane of the sanitary napkin 20 that is generally perpendicular to the longitudinal direction.

FIG. 1 also shows that the main body portion of the sanitary napkin 20 has a periphery 30 which is defined by the outer edges of the main body portion of the sanitary napkin 20 in which the longitudinal edges (or "side edges") are designated 31 and the end

edges (or "ends") are designated 32. In the embodiment depicted in FIG. 1, the sanitary napkin 20 is symmetrical with respect to both the longitudinal and transverse centerlines. Sanitary napkin 20 preferably includes side flaps or "wings" 34 that are folded around the 5 crotch portion of the wearer's panties. The side flaps 34 can serve a number of purposes, including, but not limited to, protecting the wearer's panties from soiling and keeping the sanitary napkin secured to the wearer's panties. While the topsheet 22, the backsheet 23, and the absorbent core 25 may be assembled in a variety of well known configurations (including so called "tube" products or side flap products), preferred sanitary napkin 10 configurations are described generally in U.S. Pat. No. 4,950,264, "Thin, Flexible Sanitary Napkin" issued to Osborn on Aug. 21, 1990; U.S. Pat. No. 4,425,130, "Compound Sanitary Napkin" issued to DesMarais on Jan. 10, 1984; U.S. Pat. No. 4,321,924, "Bordered Disposable Absorbent Article" issued to Ahr on Mar. 30, 1982; U.S. Pat. No. 4,589,876, "Shaped Sanitary Napkin With Flaps" issued to Van Tilburg on 15 Aug. 18, 1987.

FIG. 1 shows a preferred embodiment of the sanitary napkin 20 in which the topsheet 22 and the backsheet 23 have length and width dimensions generally larger than those of the absorbent core 25. The topsheet 22 and the backsheet 23 extend beyond the edges of the absorbent core 25 to thereby form not only portions of the periphery 31 but 20 also side flaps 34. The backsheet 23 and the topsheet 22 are positioned adjacent the garment surface 20B and the body surface 20A, respectively, of sanitary napkin 20 and are preferably joined to each other to form a perimeter 30. For example, the backsheet 23 and the topsheet 22 can be secured to each other by a uniform continuous layer of adhesive, a patterned layer of adhesive, or an array of separate lines, spirals, or spots of 25 adhesive. Adhesives that have been found to be satisfactory are manufactured by H. B. Fuller Company of St. Paul, Minn. under the designation HL-1258 or H-2031. Alternatively, topsheet 22 and backsheet 23 can be joined to each other by heat bonding, pressure bonding, ultrasonic bonding, dynamic mechanical bonding, or any other suitable method for joining topsheets and backsheets known in the art.

30 FIG. 2 shows the individual components of the sanitary napkin 20 incorporating the absorbent web layer of the present invention. The sanitary napkin 20 preferably comprises at least three primary components. These include a liquid pervious topsheet 22, a liquid impervious backsheet 23, and an absorbent core 25 positioned between the topsheet 22 and the backsheet 23. Preferably, the sanitary napkin 20 also comprises at 35 least one optional acquisition component 44. The acquisition component 44 may either be a separate component positioned between the topsheet 22 and the absorbent core 25, or

it may comprise part of a composite topsheet or part of the absorbent core 25. A disposable absorbent article which incorporates the web of the present invention need not necessarily incorporate all of the components listed above. For example, a tampon may 5 only incorporate a web layer or layers of the present invention, or may incorporate a liquid pervious topsheet and an absorbent core comprising one or more web layers of the present invention.

In the sanitary napkin 20 embodiment shown in the drawings, the topsheet 22 is a liquid pervious component that permits liquids (e.g., menses and/or urine) to penetrate 10 readily through its thickness. The topsheet 22 is preferably as compliant, soft feeling, and non-irritating to the wearer's skin as possible. A suitable topsheet 22 may be manufactured from a wide range of materials such as woven and nonwoven materials; polymeric materials such as apertured formed thermoplastic films, apertured plastic films, and hydroformed thermoplastic films; porous foams; reticulated foams; reticulated 15 thermoplastic films; and thermoplastic scrims. Suitable woven and nonwoven materials can be comprised at least partially of natural fibers (e.g., wood or cotton fibers), synthetic fibers (e.g., polymeric fibers such as polyester, polypropylene, or polyethylene fibers) or from a combination of natural and synthetic fibers.

Preferred topsheets for use in the present are selected from high loft nonwoven 20 topsheets and apertured formed film topsheets. Apertured formed films are especially preferred for the topsheet because they are pervious to body exudates and yet non-absorbent and have a reduced tendency to allow fluids to pass back through and rewet the wearer's skin. Thus, the surface of the formed film which is in contact with the body remains dry, thereby reducing body soiling and creating a more comfortable feel for the 25 wearer. Suitable formed films are described in U.S. Patent 3,929,135, entitled "Absorptive Structures Having Tapered Capillaries", which issued to Thompson on December 30, 1975; U.S. Patent 4,324,246 entitled "Disposable Absorbent Article Having A Stain Resistant Topsheet", which issued to Mullane, et al. on April 13, 1982; U.S. Patent 4,342,314 entitled "Resilient Plastic Web Exhibiting Fiber-Like Properties", which issued 30 to Radel, et al. on August 3, 1982; U.S. Patent 4,463,045 entitled "Macroscopically Expanded Three-Dimensional Plastic Web Exhibiting Non-Glossy Visible Surface and Cloth-Like Tactile Impression", which issued to Ahr et al. on July 31, 1984; U.S. Patent 4,780,352 entitled "Covering Structure For Absorbent Hygienic Sanitary Products, and an Absorbent Product Having Such A Covering", which issued to Palumbo on October 25, 35 1988; U.S. Patent 5,006,394 "Multilayer Polymeric Film" issued to Baird on April 9, 1991.

In preferred embodiments of the present invention, the body surface of the topsheet 22 is hydrophilic so that liquids will be transferred through the topsheet more readily. This diminishes the likelihood that menstrual fluid will flow off the topsheet rather than flowing into and being absorbed by the absorbent core. The body surface of the topsheet 22 can be made hydrophilic by treating it with a surfactant. Suitable methods of treating a topsheet with a surfactant are described in U.S. Patent 4,950,254 issued to Osborn and in U.S. Patent 5,520,875.

In a preferred embodiment, the topsheet 22 comprises an apertured formed film made in accordance with U.S. Patents 4,342,314 issued to Radel, et al. and 4,463,045 issued to Ahr, et al., which is marketed on sanitary napkins as the DRI-WEAVE topsheet by The Procter & Gamble Company of Cincinnati, OH. Such an apertured film is preferably obtained as product No. X-5652 from Tredegar Film Products of Terre Haute, IN. In this preferred embodiment, during manufacture the resin used to form the apertured film is preferably provided with a surfactant incorporated therein as is described in SIR No. H1670 published July 1, 1997 in the name of Aziz, et al.

In a particularly preferred embodiment, the topsheet 22 is an apertured formed film which comprises microscopic surface aberrations on the land areas of the formed film. The film also includes microscopic depositions of a low surface energy material at least some of which depositions are located on the land areas between the microscopic surface aberrations. Such a preferred apertured formed film is more fully described in allowed U.S. Patent Application Serial No. 08/826,508 entitled "Fluid Transport Webs Exhibiting Surface Energy Gradients" filed in the name of Ouellette, et al. on April 11, 1997 (PCT Publication WO 96/00548, published January 11, 1996). The combination of the absorbent web of the present invention as an absorbent core with the topsheet described in this paragraph within a sanitary napkin or similar absorbent article, provides a unique combination of softness and dryness characteristics (as measured by re-wet performance). The advantages of such combinations are more fully described in co-pending U.S. Patent Application Serial No. 60/128267, filed on April 8, 1999, in the name of Walker, III.

The backsheet 23 prevents the exudates absorbed and contained in the absorbent core 25 from wetting articles which contact the sanitary napkin 20 such as pants, pajamas and undergarments. The backsheet 23 is preferably resistant to the flow of liquids, and more preferably is impervious to liquids (e.g., menses and/or urine). The backsheet 23 is preferably manufactured from a flexible material. As used herein, the term "flexible" refers to materials which are compliant and will readily conform to the general shape and

contours of the human body. The backsheet 23 may comprise a woven or nonwoven material, polymeric films such as thermoplastic films of polyethylene or polypropylene, or composite materials such as a film-coated nonwoven material. Preferably, the 5 backsheet 23 is a polyethylene film having a thickness of from about 0.012 mm (0.5 mil) to about 0.051 mm (2.0 mils). The backsheet 23 may be embossed and/or matte finished to provide a more clothlike appearance. Further, the backsheet 23 may permit vapors to escape from the absorbent core 25 (i.e., breathable) while still preventing exudates from passing through the backsheet 23. A suitable backsheet material is obtained as product 10 No. 18-1401 from the Clopay Corporation of Cincinnati, Ohio. A suitable breathable backsheet material is a laminate of an apertured film such as that described in U.S. Patent 3,929,135 issued to Thompson which is inverted so that the smaller openings of the tapered capillaries face the absorbent core 25 which is adhesively laminated to a microporous film such as that described in Exxon's U.S. Patent 4,777,073.

15 The absorbent core 25 comprises the fibrous absorbent web layer 40 of the present invention. The absorbent core 25 may be manufactured in a wide variety of sizes and shapes (e.g., rectangular, oval, hourglass, dog bone, asymmetric, etc.). The configuration and construction of the absorbent core 25 may also be varied (e.g., the absorbent core may have varying caliper zones (e.g., profiled so as to be thicker in the center), or may 20 comprise one or more layers or structures. The total absorbent capacity of the absorbent core should, however, be compatible with the design loading and the intended use of the sanitary napkin. Further, the size and absorbent capacity of the absorbent core may be varied to accommodate different uses such as incontinence pads, pantiliners, regular sanitary napkins, or overnight sanitary napkins.

25 The fibrous absorbent web 40 of the present invention is an airlaid fibrous web comprising a substantially uniform admixture of hardwood pulp fibers and softwood pulp fibers. Preferably, the fibrous absorbent web also incorporates superabsorbent material throughout the web. Additionally, the fibrous web layer 40 may also incorporate a binder material such as bicomponent binder fibers in the uniform admixture of fibers described 30 above.

In addition to one or more of the fibrous absorbent webs 40 of the present invention, the absorbent core 25 may incorporate other absorbent layers. Such other layers may include any other suitable absorbent material known in the art for such products. Additionally, as shown in FIG. 3, the absorbent core 25 may incorporate more 35 than one fibrous absorbent web 40 layer of the present invention. Such layers 40 may

have any of the variations described herein and in the appended claims as within the scope of the present invention. In the embodiment shown in FIG. 3, the two fibrous web layers 40 have a superabsorbent material 50 disposed therebetween. If desired, a superabsorbent 5 material may also be incorporated in a uniform or non-uniform manner into one or both of the fibrous web layers 40 shown in FIG. 3. In the embodiment shown in FIG. 3, each of the fibrous absorbent web layers 40 which comprise the absorbent core 25 contains a substantially uniform mixture of hardwood pulp fibers, softwood pulp fibers, and a binder material (such as bicomponent binding fibers or a powdered binder) in a thermally 10 bonded airlaid structure.

Unless otherwise noted, all ratios given below are expressed in terms of weights of the quantities being considered. Preferably, the fibrous absorbent web 40 of the present invention includes a ratio of softwood pulp fibers to hardwood pulp fibers in the range of from about 4:1 to about 1:2, more preferably from about 3:1 to about 1:1, most preferably 15 about 2:1. A particularly preferred hardwood pulp fiber is a eucalyptus fiber. A particularly suitable eucalyptus fiber includes those of the eucalyptus grandis species. The hardwood pulp fibers, and eucalyptus in particular, have high surface area, thereby providing the absorbent web with a high capillary pressure. Too much hardwood pulp fiber, however, in the web will reduce its overall absorbent capacity. Additionally, the 20 presence of excess hardwood pulp fiber may lower the fluid handling speed of the web to an unacceptably low level. Other suitable fibers for use as a hardwood pulp fiber in the fibrous web layer 40 of the present invention may include acacia, oak, maple, or cherry fibers.

The hardwood pulp fibers are blended in the fibrous absorbent web 40 with a 25 multiplicity of softwood pulp fibers. The softwood pulp fibers are preferably blended into the web in the ratios indicated above. A particularly preferred softwood pulp fiber is southern softwood kraft fibers. Other suitable softwood fibers include western or northern softwood kraft fibers.

The blend of hardwood pulp fibers and softwood pulp fibers provides a web with 30 different sized fibers incorporated throughout. This provides a good distribution of fiber surface area. As noted above, the use of hardwood fibers involves tradeoffs between capillary pressure, and capacity and/or fluid handling speed. Because the fibrous webs 40 of the present invention are airlaid, they are readily amenable to the inclusion of a superabsorbent material. Such superabsorbent material will improve the overall capacity 35 of the web, thereby advantageously combining high capacity and high capillary pressure.

The fibrous absorbent web 40 of the present invention preferably incorporates bicomponent binding fibers and/or a superabsorbent material. In more preferred embodiments, both the bicomponent fibers and the superabsorbent material are present in the web and are blended in a substantially uniform mixture throughout the web thickness.

The addition of bicomponent fibers allows for positive stiffness control of the overall layer. The stiffness of the web is controlled by adjusting the amount of bicomponent fiber as well as the time and temperature parameters of the thermal bonding process. In a particularly preferred embodiment, about 5% to about 30%, more preferably about 15% to about 25%, of the web is bicomponent fibers. A preferred fiber comprises a polyethylene / polypropylene fiber in which the polypropylene core is surrounded by a polyethylene sheath. Such a suitable 50%/50% concentric bicomponent fiber is available from Danaklon of Varde, Denmark.

Other binder materials may be included within the web structure as well. Polyethylene powder binders and/or latex binder material may be, but need not be, incorporated into the web structure. The use of a powder binder such as polyethylene allows the web to be a thermally bonded structure as is the case with the bicomponent binder fibers described above. If latex, or a similar binder is used, the latex will act as the binder and the structure may be described as "latex bonded."

Any variety of superabsorbent particulate material may be incorporated into the fibrous absorbent web of the present invention. One especially preferred material is SAB 960 available from Stockhausen Louisiana, Ltd. of Garyville, LA. Other especially preferred superabsorbent materials include surface crosslinked polyacrylates such as ASAP 2300 available from Chemdal, Corp. of Palatine, IL and the mixed bed materials described in copending, commonly assigned US Patent application Serial No. 09/258,890, filed in the name of Hird, et al. on March 1, 1999. A superabsorbent fiber known as "FIBERDRI" available from Camelot Superabsorbents, Ltd., Calgary, Alberta, is also suitable. The superabsorbent material may take any suitable form including fibers, flakes, or small discrete particles. As used herein, the term "particles" is intended to mean any of these forms of superabsorbent material. In preferred embodiments, the superabsorbent material comprises small flakes or discrete particulate material incorporated into the web 40. Such superabsorbent material preferably comprises from about 10% to about 50% of the overall fibrous absorbent web. A higher amount of such superabsorbent material increases the overall capacity of the web layer 40. Excess superabsorbent material,

however, may reduce the permeability of the web layer 40 due to gel blocking or similar effects.

The fibrous absorbent web of the present invention may be made by any suitable 5 airlaying technique known in the art. The use of airlaying allows the incorporation of particulate superabsorbent material throughout the structure, as well as greater positive control over the web physical properties than may be possible with other web forming techniques.

When the web incorporates bicomponent fibers, the web is preferably formed using 10 a thermally bonded airlaid technique as described above. In such a construction, the use of additional binder material such as powder binder or latex is not required. Such additional materials may, nonetheless, be included in order to form a multi-bonded airlaid web. Additionally the web need not incorporate any bicomponent fiber, and may use 15 latex in combination with the superabsorbent particles and hardwood and softwood pulp fibers as described above to form a latex bonded airlaid structure. Suitable methods of forming such airlaid structures are well known in the art. Another alternative includes the use of a powdered binder such as polyethylene together with a multiplicity of hardwood pulp and softwood pulp fibers to form a thermally bonded airlaid web.

U.S. Patent 5,445,777 describes a preferred method of adding a particulate 20 superabsorbent material and/or a powdered binder material (such as the polyethylene binder described above) to a fibrous airlaid web. Such techniques are suitable for construction of the fibrous absorbent webs 40 of the present invention.

The airlaid web may be made with any suitable basis weight and thickness for the 25 article in which is to be utilized. A preferred web for use in a sanitary napkin may have a total basis weight of about 60 to about 400 g/m² and a preferred density of about 0.05 to about 0.2 g/cc. Any suitable thickness may be used. In the sanitary napkin 20 shown in FIGS. 1-2, the thickness of the web 20 of the present invention may be about 1.5 mm.

As noted the absorbent web layer 40 of the present invention provides for high 30 capillary pressure, and improved control over the overall flexibility characteristics of absorbent articles into which it is incorporated. In particularly preferred embodiments, the fibrous absorbent web 40 of the present invention comprises the above described combination of hardwood pulp fibers and softwood pulp fibers in an airlaid fibrous web. The web stiffness properties are controlled as described above to yield a layer with a Taber stiffness of less than or equal to 3 Taber stiffness units. Taber stiffness is measured

using the Taber stiffness test described in ASTM standard D5650-97 "Standard Test Method for Resistance to Bending of Paper of Low Bending Stiffness (Taber-Type Tester in 0 to 10 Taber Stiffness Unit Configuration)," available from the American Society for
5 Testing and Materials, West Conshohocken, PA.

The acquisition component (or "acquisition layer" or "distribution layer") 44, if used, preferably lies beneath the topsheet 22. The terms "layer" or "web", as used herein, include but are not limited to single unfolded sheets, folded sheets, strips of material, loose or bonded fibers, multiple layers or laminates of material, or other combinations of
10 such materials. These two terms are thus, not limited to single unfolded layers or sheets of material. The acquisition component 44 may provide void volume beneath the topsheet 22 to increase the ability of the sanitary napkin to draw liquids through the topsheet 22. In the preferred embodiment described herein, the acquisition component 44 preferably provides resiliency to lateral compressive forces so that the sanitary napkin
15 20 has improved resistance to bunching.

The acquisition layer 44 serves to collect quickly and temporarily hold discharged bodily fluids, as well as facilitating transport the fluid from the point of initial fluid contact to other parts of the acquisition layer 44 and the absorbent core 25. There are several reasons why the improved transport of exudates is important, including providing
20 a more even distribution of the exudates throughout the absorbent core and allowing the sanitary napkin 20 to be made relatively thin. The transport referred to herein may encompass the transportation of liquids in one, two or all directions (i.e., in the x-y plane and/or in the z-direction). The acquisition layer 44 may be comprised of several different materials including nonwoven or woven webs of synthetic fibers including polyester,
25 polypropylene, or polyethylene, natural fibers including cotton or cellulose, blends of such fibers, or any equivalent materials or combinations of materials. Examples of sanitary napkins having an acquisition layer 44 and a topsheet 22 are more fully described in U.S. Pat. No. 4,950,264 issued to Osborn and U.S. patent application Serial. No. 07/810,774, "Absorbent Article Having Fused Layers", filed Dec. 17, 1991 in the names
30 of Cree, et al. Each of these references are incorporated herein by reference. In a preferred embodiment, the acquisition layer may be joined with the topsheet by any of the conventional means for joining webs together, most preferably by fusion bonds as is more fully described in the above-referenced Cree application.

The acquisition component 44 should be liquid permeable. The acquisition component 44 is also preferably compliant, soft feeling, and non-irritating to the user's
35

skin. The acquisition component 44 has a body-facing face (or side), and a garment-facing face. The acquisition component 44 may be of any suitable size and shape. In the embodiment shown in FIG. 1, the acquisition component 44 is in the shape of a race track with slightly concave side edges, as is the portion of the topsheet 22 that overlies the main body portion of the sanitary napkin 20. The dimensions of the acquisition component 44, however, are preferably not as large as those of the topsheet 22.

The acquisition component 44 is preferably made from any materials suitable for the above purposes that are capable of having the topsheet 22 fused to them. The acquisition component 44 may, for example, be comprised of woven or nonwoven materials. The fibers or other components of these materials may be synthetic, or partially synthetic and partially natural. Suitable synthetic fibers include polyester, polypropylene, polyethylene, nylon, viscous rayon, or cellulose acetate fibers. Suitable natural fibers include cotton, cellulose, or other natural fibers. The acquisition component 44 may also be at least partially comprised of cross-linked cellulose fibers. The acquisition component 44, if nonwoven, can be made by a number of different processes. These include, but are not limited to: air laid, wet laid, meltblown, spunbonded, carded, thermally bonded, air-through bonded, powder bonded, latex bonded, solvent bonded, spunlaced, and combinations of the foregoing.

The acquisition component 44 may be constructed in the manner described in U.S. Patent 5,549,589, issued on August 27, 1996 in the name of Horney et al. with respect to the distribution layer described therein. Another preferred construction for the acquisition component 44 is a laminate of two nonwoven materials. The uppermost layer of this laminate (or "secondary topsheet") preferably comprises an 19 g/yd² (22.5 g/m²) spunbonded polypropylene nonwoven material referred to as product No. 065MLPV60U (or "P-9") obtained from Fiberweb, North America of Washougal, WA. The underlying layer of the laminate (or "tertiary topsheet") preferably comprises a multi-bonded air laid nonwoven material that is thermally bonded using powder bonding and latex bonding. In a preferred embodiment, this multi-bonded air laid nonwoven material comprises about 77% cellulose fibers, about 20% powder binder, and about 3% latex binder (1.5% sprayed on each side of the web) and has a basis weight of about 50 g/yd² (about 60 g/m²). (Unless otherwise stated, all percentages herein are by weight.) Such a multi-bonded air laid nonwoven is preferably obtained as product No. 90830X312 from Merfin Hygienic Products, Ltd. of Delta, British Columbia. These two nonwoven layers are preferably laminated together by depositing the multi-bonded air laid nonwoven material on the

spunbonded polypropylene nonwoven material. The spunbonded material is used as a process aid or carrier web in the process of forming this laminate.

In alternative embodiments, the spunbonded polypropylene nonwoven material
5 may have a greater or a lower basis weight, or it may be replaced by an air laid tissue, a wet laid tissue, or any of the materials described above. If a wet laid tissue is used instead of a polypropylene nonwoven material, the orientation of the laminate is preferably reversed so that in the finished product, the multi-bonded air laid nonwoven material lies above the wet laid tissue layer. In the case of thicker sanitary napkins, any of the
10 acquisition components described above can be used. Additionally, in one preferred thicker sanitary napkin embodiment, a low density latex bonded air laid material can be used as the entire acquisition component (that is, no tertiary topsheet is required). A low density latex bonded air laid material suitable for this purpose is a material having a basis weight of about 80 g/m² known as product No. FG413MHB, which is obtained from
15 Walkisoft, USA of Mt. Holly, NC.

The topsheet 22 described herein is preferably fused to the acquisition component
44 or to the absorbent core 25, or to both. A suitable manner for fusing (or integrating) the topsheet to underlying components at discrete sites is described in U.S. Patent Application Serial No. 09/074,909 filed on May 8, 1998, in the name of Daniels et al. and
20 in International Patent Application Serial No. PCT/US96/2087, filed on December 20, 1996, in the name of Lynard et al., which application designates the United States. As described in the above-referenced applications, the bonding of the topsheet to underlying layers is preferably done at discrete locations and the center of the article is provided with an "un-bonded window."

25 The topsheet 22, the acquisition component 44, if included, the backsheet 23, and the absorbent core 25 may be assembled in a variety of configurations known in the art (including layered or "sandwich" configurations and wrapped or "tube" configurations). FIGS. 1 and 2 show a preferred embodiment of the sanitary napkin 20 assembled in a sandwich construction. In FIGS. 1 and 2, the topsheet 22 and the backsheet 23 have
30 length and width dimensions generally larger than those of the absorbent core 25. The topsheet 22 and the backsheet 23 extend beyond the edges of the absorbent core 25 to form portions of the periphery 30. The garment-facing side of the topsheet 22 is preferably joined to the body-facing side of the acquisition component 44 as described above. The acquisition component 44 may be joined to the absorbent core 25, if desired.
35 If these components are joined, they can be joined in any of the manners described herein

for joining the topsheet 22 to the acquisition component 44. However, in the embodiment shown in the drawings, the acquisition component 44 is not directly joined to the absorbent core 25. The backsheet 23 is preferably joined to the garment-facing side of the
5 absorbent core by adhesives.

The portions of the topsheet 22 and backsheet 23 that extend beyond the edges of the absorbent core 25 and the acquisition component 44 are preferably also joined to each other. These portions of the topsheet 22 and backsheet 23 can be joined in any suitable manner known in the art. The term "joined", as used in this specification, encompasses
10 configurations in which an element is directly secured to another element by affixing the element directly to the other element; configurations in which the element is indirectly secured to the other element by affixing the element to intermediate member(s) which in turn are affixed to the other element; and configurations in which one element is integral with another element, i.e., one element is essentially part of the other element. Preferably,
15 in the embodiment shown, these portions of the topsheet 22 and backsheet 23 are joined using adhesives over substantially the entire portions that extend beyond the edges of the absorbent core 25 and a crimp seal at the end edges 32 of the main body portion where the topsheet 22 and backsheet 23 are densified by the application of pressure or heat and pressure.

20 The sanitary napkin 20 shown in FIGS. 1-2, as discussed above, preferably comprises an optional pair of flaps 34 that are joined to the main body portion. The flaps 34 extend laterally outward beyond the longitudinal side edges of the main body portion from their proximal edges to their distal edges (or "free end"). The flaps 34 extend outward from at least the central region of the main body portion.

25 The flaps 34 can be joined to the main body portion in any suitable manner. Preferably, in the embodiments shown in FIGS. 1-2, the flaps 34 are integral with the main body portion (that is, the flaps 34 comprise integral extensions of the topsheet 22 and backsheet 23). In other alternative embodiments, the flaps 34 can comprise separate components that are joined to the main body portion.

30 The flaps 34 can be in any suitable configuration. Suitable flaps are described in Reexamined Patent No. B1 4,589,876 entitled "Sanitary Napkin", issued to Van Tilburg, Certificate of Reexamination issued April 27, 1993; U.S. Patent 4,687,478 entitled "Shaped Sanitary Napkin With Flaps", which issued to Van Tilburg on August 18, 1987; U.S. Patent 5,389,094 entitled "Absorbent Article Having Flaps and Zones of Differential Extensibility" issued to Lavash, et al. on February 14, 1995; U.S. Patent 5,558,663

entitled "Absorbent Article Having Undergarment Covering Components With Zones of Extensibility" issued to Weinberger, et al. on September 24, 1996 (which describes an alternative to flaps that are applied by the wearer); and in International Patent Application
5 Serial No. PCT US 96/15957 entitled "Absorbent Article Having Flaps With Step Configuration and Zones of Extensibility" filed on October 3, 1996, in the name of Lash, et al. Other preferred features for the flaps 34 including a deformed region that forms a hinge and zones of extensibility or zones of differential extensibility are described in U.S. Patent Application Serial No. 09/074,909 filed on May 8, 1998, in the name of Daniels et
10 al. and International Patent Application Serial No. PCT/US96/2087, filed on December 20, 1996, in the name of Lynard et al., which application designates the United States.

The garment surface 20B of the sanitary napkin 20 may include, and preferably does include, fasteners for attaching the sanitary napkin to the wearer's undergarment. FIG. 2 shows the central pad fastener 82 which is adapted to secure the main body portion
15 of the sanitary napkin to the crotch region of an undergarment. Any types of fasteners known in the art, such as adhesive fasteners and mechanical fasteners can be used. Fasteners comprising adhesives have been found to work well for this purpose, with pressure-sensitive adhesives being preferred. In a preferred embodiment, the central pad fastener 82 comprises a pair of spaced apart longitudinally-oriented strips or zones of
20 adhesive that are centered about the longitudinal centerline L.

The outer surface of the flaps 34, adjacent the distal edges of the flaps, is preferably provided with a flap adhesive 84. The flap adhesive 84 is used to assist in maintaining the flaps 34 in position after they are wrapped around the edge of the crotch portion of the panty. Suitable adhesive fasteners are described in greater detail in U.S. Patent
25 4,917,697. The flaps 34 can be maintained in position by attaching the flaps 34 to the undergarment, or to the opposing flap.

The fasteners used with the present invention are not limited to adhesive attachment means. Any type of fastener used in the art can be used for such purpose. For example, the sanitary napkin 20 could be secured to the wearer's undergarment by mechanical
30 fasteners, such as VELCRO, or the fasteners described in U.S. Patent 4,946,527 entitled "Pressure-Sensitive Adhesive Fastener and Method of Making the Same" issued to Battrell on August 7, 1990, or U.S. Patent 5,392,498 entitled "Non-Abrasive Skin Friendly Mechanical Fastening System" issued to Goulait, et al. on February 28, 1995. For simplicity, however, the fasteners will be described in terms of adhesive attachment
35 means.

The adhesive attachment means are respectively covered by removable release liners, central pad release liner and flap release liner, both designated 86. The pressure-sensitive adhesives should be covered with release liners 86 to keep the adhesives from sticking to extraneous surfaces prior to use. Suitable release liners are described in U.S. Patent 4,917,697. A particularly preferred release liner which also serves as an individual package for wrapping the sanitary napkin is described in U.S. Patent 4,556,146 issued to Swanson, et al.

Numerous other embodiments of the sanitary napkin 20 are possible. For example, 10 the main body portion of the sanitary napkin can be provided in the form of a compound sanitary napkin that has its components bonded as described herein for improved integrity and acquisition. General descriptions of compound sanitary napkins are found in P&G's U.S. Patent 4,425,130 entitled "Compound Sanitary Napkin" issued to DesMarais, et al. on January 10, 1984, and in Statutory Invention Registration H1614 entitled "Body 15 Fitting Compound Sanitary Napkin", published in the name of Mayer, et al. on November 5, 1996. To form the compound sanitary napkin, a sanitary napkin such as that described herein can serve as the panty protector (or "base pad") and a tube of absorbent material wrapped by a topsheet (or "primary menstrual pad") can be placed on top of the sanitary napkin and attached thereto at the ends. The fusion bonding on the base pad is preferably 20 distributed in the same manner as shown on the drawings herein. The attachment of the tube to the sanitary napkin is preferably achieved by fusion bonding extensions of the topsheet material at the ends of the tube to the base pad. In some preferred embodiments of such a compound sanitary napkin, there may also be attachment between the ends of the tube of absorbent material and the base pad. The tube of the compound sanitary 25 napkin can be attached to the base pad between its ends by any suitable attachment means, such as by adhesives.

The sanitary napkin 20 of the present invention is utilized by removing the release liners 86 and placing the sanitary napkin 20 in a panty. The main body portion 22 is placed in the crotch portion of the panty with one end of the main body portion 22 extending towards the front section of the panty and the other end towards the back section of the panty. The backsheet 23 is placed in contact with the inner surface of the center of the crotch portion of the panty. The central pad adhesive fastener 82 maintains main body portion in position. The distal portions of the flaps 34 are folded around the side edges of the panty. The flap adhesives 84 secure the flaps 34 to the underside of the panty or to the opposing flap.

The absorbent web layer of the present invention may also be incorporated into other types of disposable absorbent articles such as pantiliners, incontinence pads, diapers, or tampons.

- 5 The disclosures of all patents, patent applications (and any patents which issue thereon, as well as any corresponding published foreign patent applications), and publications mentioned throughout this patent application are hereby incorporated by reference herein. It is expressly not admitted, however, that any of the documents incorporated by reference herein teach or disclose the present invention. It is also
10 expressly not admitted that any of the commercially available materials or products described herein teach or disclose the present invention.

While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention.

What is claimed is:

1. A fibrous absorbent web layer comprising:
 - a multiplicity of hardwood pulp fibers, preferably eucalyptus fibers,
 - a multiplicity of softwood pulp fibers; preferably southern softwood kraft fibers,
 - said hardwood pulp fibers and said softwood pulp fibers being incorporated in a substantially uniform admixture within an airlaid fibrous web,
 - said airlaid fibrous web further comprising a superabsorbent material incorporated throughout said fibrous web layer.
2. The fibrous absorbent web of Claim 1 wherein the ratio of said softwood pulp fibers to said hardwood pulp fibers is in the range of from about 4:1 to about 1:2, preferably in the range of from about 3:1 to about 1:1.
3. A fibrous absorbent web layer comprising:
 - a multiplicity of hardwood pulp fibers, preferably eucalyptus fibers,
 - a multiplicity of softwood pulp fibers, preferably southern softwood kraft fibers,
 - a binder material, preferably a polyethylene powder binder, more preferably a bicomponent binder fiber, even more preferably a latex,
 - said hardwood pulp fibers, said softwood pulp fibers, and said binder material being substantially uniformly incorporated within a thermally bonded airlaid fibrous web.
4. The fibrous absorbent web of Claim 3 wherein the ratio of said softwood pulp fibers to said hardwood pulp fibers is in the range of from about 3:1 to about 1:1.
5. A disposable absorbent article comprising:
 - a liquid impervious backsheet;
 - a liquid pervious topsheet joined to said backsheet, said topsheet preferably comprised of a nonwoven web, more preferably comprised of an apertured formed film;

wherein each of said first and second fibrous web layers is a thermally bonded airlaid fibrous web comprising a multiplicity of hardwood pulp fibers, a multiplicity of softwood pulp fibers, and a binder material.

9. A fibrous absorbent web layer comprising:
 - a multiplicity of southern softwood kraft fibers,
 - a multiplicity of eucalyptus fibers,
 - a multiplicity of bicomponent binding fibers,
said southern softwood kraft fibers, said eucalyptus fibers, and said bicomponent binding fibers being incorporated in a substantially uniform admixture within and airlaid fibrous web, and
said airlaid fibrous web further comprising a surface coating of latex.
10. The fibrous absorbent web of any of the preceding claims wherein said fibrous web further comprises superabsorbent material, preferably said superabsorbent material is incorporated substantially uniformly throughout said web.

an absorbent core for storage of absorbed fluids disposed between said topsheet and said backsheet, said absorbent core comprising;

a multiplicity of hardwood pulp fibers, preferably eucalyptus fibers,

a multiplicity of softwood pulp fibers, southern softwood kraft fibers,

said hardwood pulp fibers and said softwood pulp fibers being incorporated in a substantially uniform admixture within an airlaid fibrous web,

said airlaid fibrous web further comprising a superabsorbent material incorporated throughout said fibrous web layer.

6. A fibrous absorbent web layer comprising:

a multiplicity of hardwood pulp fibers, preferably eucalyptus fibers,

a multiplicity of softwood pulp fibers, preferably southern softwood kraft fibers,

said hardwood pulp fibers and said softwood pulp fibers being incorporated in a substantially uniform admixture within an airlaid fibrous web,

said airlaid fibrous web having a Taber stiffness of less than 3 Taber stiffness units.

7. The fibrous absorbent web of Claim 8 further comprising a multiplicity of bicomponent binder fibers incorporated in a substantially uniform admixture within said fibrous web.

8. A disposable absorbent article comprising:

a liquid impervious backsheet;

a liquid pervious topsheet joined to said backsheet;

an absorbent core for storage of absorbed fluids disposed between said topsheet and said backsheet, said absorbent core comprising;

a first fibrous web layer,

a second fibrous web layer,

a layer of absorbent material disposed between said first and second fibrous web layers,

1/2

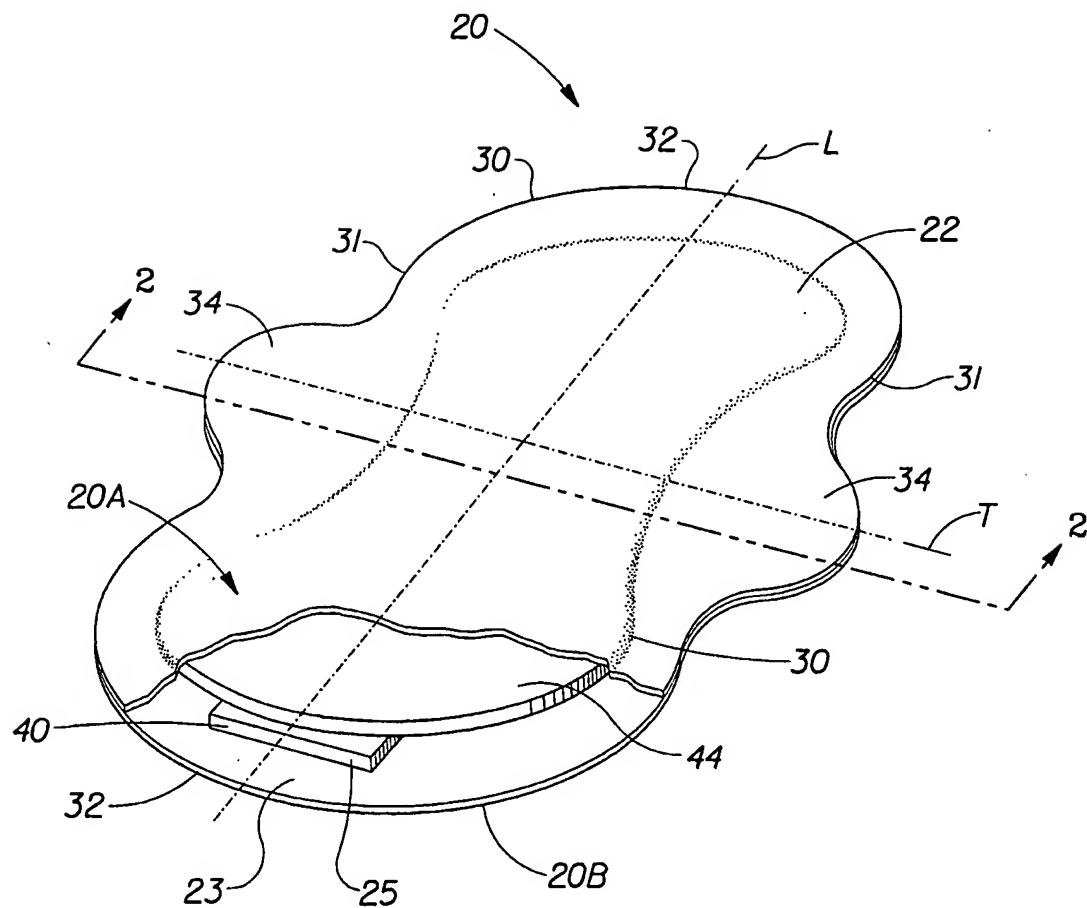


Fig. 1

2/2

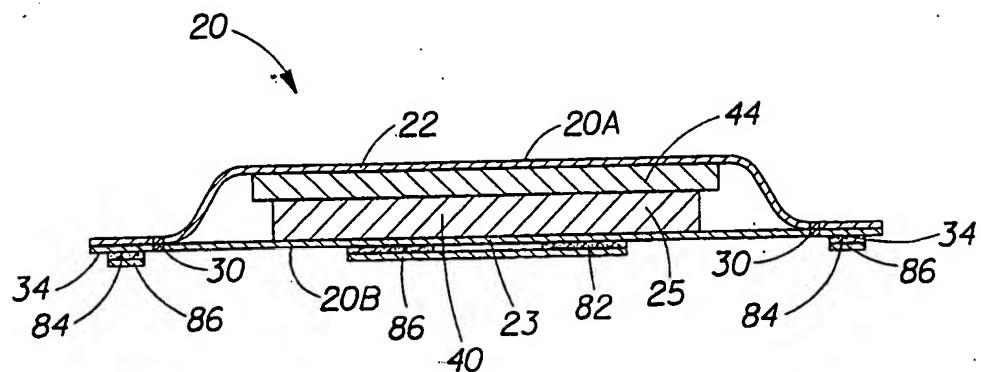


Fig. 2

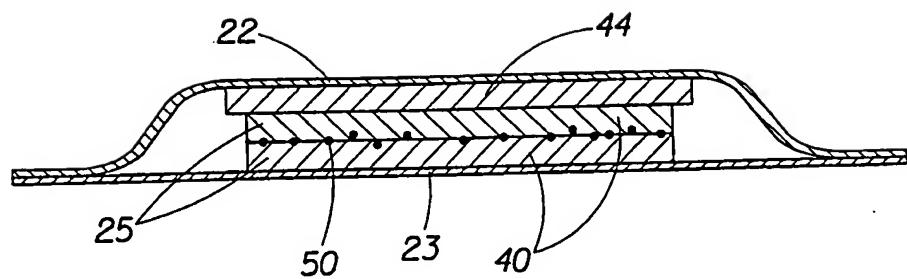


Fig. 3

INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/US 00/09519

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61F13/15

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 492 554 A (KIMBERLY CLARK CO) 1 July 1992 (1992-07-01) page 3, line 43 -page 4, line 43 page 6, line 19 - line 39 page 8, line 28 -page 9, line 4; figure 7; example 13 ---	1-10
X	EP 0 600 454 A (KIMBERLY CLARK CO) 8 June 1994 (1994-06-08) page 3, line 4 -page 4, line 30 page 6, line 40 - line 46 ---	1,2,5,6, 8-10
X	WO 92 18171 A (PROCTER & GAMBLE) 29 October 1992 (1992-10-29) page 27, paragraph 3 page 29, paragraph 2 page 40, paragraph 3 -----	1,2,5,6, 8-10

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
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- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

21 July 2000

Date of mailing of the international search report

04/08/2000

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 00/09519

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